CLAIMS

1. A method of limiting a combined signal, the method comprising multiplying an information signal intended for each subscriber terminal by a spreading code and a weighting coefficient, which is proportional to the power of the transmission directed to the subscriber terminal, and combining transmissions intended for various subscriber terminals into a combined signal, comprising:

setting a threshold value for power or amplitude values of the combined signal,

dividing a chip sequence of the combined signal into blocks,

comparing the values of each block with the set threshold value to find out whether the combined signal needs to be limited, and if the threshold value is exceeded

decorrelating the block where the threshold value was exceeded and a pre-determined number of channelization codes, which have a predetermined spreading factor, and performing normalization to determine first weighting coefficients for the channelization codes or channelization code groups, the first weighting coefficients being proportional to the power of transmissions directed to pre-determined subscriber terminals,

comparing each combination of the first weighting coefficient and the related channelization code with the set objectives and determining second weighting coefficients for the selected downlink transmissions as a result of the comparison, the second weighing coefficients being proportional to the power of transmissions directed to pre-determined subscriber terminals,

re-forming the examined block using combinations of the channelization codes and the weighting coefficients that were determined, the weighting coefficients being second weighting coefficients provided that they have been determined, or otherwise first weighting coefficients, and thus the examined block of the combined signal becomes limited in respect of the power or amplitude.

2. A method of limiting a combined signal, the method comprising multiplying an information signal intended for each subscriber terminal by a spreading code and a weighting coefficient, which is proportional to the power of the transmission directed to the subscriber terminal, and combining trans-

missions intended for various subscriber terminals into a combined signal, comprising:

setting a threshold value for the power or amplitude values of the combined signal,

dividing a chip sequence of the combined signal into blocks,

comparing the values of each block with the set threshold value to find out whether the combined signal needs to be limited, and if the threshold values is exceeded

forming a residual signal,

searching for channelization codes that are unused at a given time, and decorrelating the residual signal and the unused channelization codes to determine weighting coefficients,

forming an estimate of the residual signal by means of the unused channelization codes, the weighting coefficients and one or more vectors selected from the sum vectors corresponding to the unused channelization codes,

forming a clipped signal by subtracting the estimate of the residual signal from the combined signal of the examined block, and thus the examined block of the combined signal becomes limited in respect of the power or amplitude.

3. A method according to claim 1 wherein all channelization codes that have the same pre-determined spreading factors are used in decorrelation.

4. A method according to claim 1, wherein decorrelation is performed by calculating the input of vectors using the block where the threshold value was exceeded and a pre-determined number of channelization codes.

5. A method according to claim 2, wherein the combined signal is divided into chip blocks whose length is the same as the spreading factor of the channelization code.

6. A method according to claim 1, wherein the set objective is not to exceed the maximum value limit of the peak code domain error according to the standard of the telecommunications system used.

7. A method according to claim 1, wherein the set objective is to keep the channelization codes orthogonal.

8. A method according to claim 1, wherein the set objective is not to exceed the error vector magnitude EVM according to the standard of the telecommunications system used.

9. A method according to claim 2, wherein the threshold value is determined so that the desired peak-to-mean ratio (peak-to-average ratio, crest factor) of the power or amplitude is achieved.

10. A method according to claim 1, wherein normalization is performed by dividing the decorrelation result by the selected spreading factor of the channelization code.

11. A method according to claim 1, wherein the weighting coefficients of the combined signal are defined for the codes.

12. A method according to claim 1, wherein the weighting coefficients of the combined signal are defined for the code groups.

13. A method according to claim 2, wherein the signal to be added to the combined signal is an orthogonal signal.

14. A method according to claim 2, wherein the unused codes are searched for by decorrelating the combined signal and the channelization codes and by normalizing the decorrelation result by dividing it by the channelization code length.

15. A method according to claim 2, wherein the signal to be added to the combined signal is a non-orthogonal signal.

16. A method according to claim 2, wherein the residual signal is formed by determining a residual value for each chip of a block as follows: if the chip value is greater than the threshold value, the threshold value is subtracted from the chip and the result of this subtraction is the residual value; if the absolute value of the chip at most equals to the threshold value, the residual value is zero; if the chip value is lower than the negation of the threshold value, the threshold value is added to the chip value and the result of this addition is the residual value.

17. A method according to claim 2, wherein the estimate of the residual signal is formed by multiplying each unused channelization code and the corresponding weighting factor and by adding up the products obtained.

18. A method according to claim 2, wherein the estimate of the residual signal is formed by first determining a partial estimate by multiplying each unused channelization code and the corresponding weighting coefficient to obtain an input vector and by adding the selected sum vector to the input

vector obtained, after which the partial estimates that were determined are added up.

19. A method according to claim 2, wherein the residual signal is formed by determining a residual value for each chip of the block as follows: if the chip value is at least zero, the standard deviation of the combined signal is subtracted from the chip value and the result of this subtraction is the residual value; if the chip value is lower than zero, the standard deviation of the combined signal is added to the chip value and the result of this addition is the residual value.

20. A method according to claim 2, wherein the sum vector is selected so that all elements are zeroes.

21. A method according to claim 2, wherein the sum vector is selected so that the sum vector comprises at least one element that is different from zero.

22. A transmitter of a radio telecommunications system where a combined signal is limited and an information signal intended for each subscriber terminal is multiplied by a spreading factor and a weighting coefficient, which is proportional to the power of the transmission directed to the subscriber terminal, and transmissions directed to several different subscriber terminals are combined into a combined signal, comprising:

means (704, 706) for setting a threshold value for the power or amplitude values of the combined signal,

means (704, 706) for dividing the chip sequence of the combined signal into blocks,

means (704, 706) for comparing the values of each block with the set threshold value to find out whether the combined signal needs to be limited,

means (704, 706) for decorrelating the block where the threshold value was exceeded and a pre-determined number of channelization codes, which have a pre-determined spreading factor, and for performing normalization to determine first weighting coefficients for the channelization codes or channelization code groups, the first weighting coefficients being proportional to the power of the transmissions directed to pre-determined subscriber terminals,

means (704, 706) for comparing each combination of a first weighting coefficient and a related channelization code with the set objectives and for

determining second weighting coefficients for downlink transmissions selected as a result of the comparison, the second weighting coefficients being proportional to the power of the transmissions directed to pre-determined subscriber terminals,

means (704, 706) for re-forming the examined block using combinations of the channelization codes and the weighting coefficients that were determined, the weighting coefficients being second weighting coefficients provided that they have been determined, or otherwise first weighting coefficients, and thus the examined block of the combined signal becomes limited in respect of the power or amplitude.

23. A transmitter of a radio telecommunications system where a combined signal is limited and an information signal intended for each subscriber terminal is multiplied by a spreading factor and a weighting coefficient, which is proportional to the power of the transmission directed to the subscriber terminal, and transmissions directed to several different subscriber terminals are combined into a combined signal, comprising:

means (704, 706) for setting a threshold value for the power or amplitude values of the combined signal,

means (704, 706) for dividing the chip sequence of the combined signal into blocks,

means (704, 706) for comparing the values of each block with the set threshold value to find out whether the combined signal needs to be limited,

means (704, 706) for forming a residual signal,

means (704, 706) for searching for the channelization codes that are unused at a given time and for decorrelating the residual signal and the unused channelization codes to determine weighting coefficients,

means (704, 706) for selecting one or more desired vectors from the sum vectors corresponding to the unused channelization codes,

means (704, 706) for forming an estimate of the combined signal by means of the unused channelization codes and the selected one or more sum vectors,

means (704, 706) for forming a clipped signal by subtracting the estimate of the residual signal from the combined signal of the examined block, and thus the examined block of the combined signal becomes limited in respect of the power or amplitude.

24. A transmitter according to claim 22, wherein all channelization codes that have the same pre-determined spreading factors are used in decorrelation.

25. A transmitter according to claim 22, wherein decorrelation is performed by calculating the input of the vectors using the block where the threshold value was exceeded and a pre-determined number of channelization codes.

26. A transmitter according to claim 22, wherein the combined signal is divided into chip blocks whose length is the same as the spreading factor of the channelization code.

27. A transmitter according to claim 22, wherein the set objective is not to exceed the maximum value limit of the peak code domain error according to the standard of the telecommunications system used.

28. A transmitter according to claim 22, wherein the set objective is to keep the channelization codes orthogonal.

29. A transmitter according to claim 22, wherein the set objective is not to exceed the error vector magnitude EVM according to the standard of the telecommunications system used.

30. A transmitter according to claim 22, wherein the threshold value is determined so that the desired peak-to-mean ratio (peak-to-average ratio, crest factor) of the power or amplitude is achieved.

31. A transmitter according to claim 22 wherein normalization is performed by dividing the decorrelation result by the selected spreading factor of the channelization code.

32. A transmitter according to claim 22, wherein the weighting coefficients of the combined signal are determined for the codes.

33. A transmitter according to claim 22, wherein the weighting coefficients of the combined signal are determined for the code groups.

34. A transmitter according to claim 23, wherein the signal to be added to the combined signal is an orthogonal signal.

35. A transmitter according to claim 23, wherein the unused codes are searched for by decorrelating the combined signal and the channelization codes and by normalizing the decorrelation result by dividing it by the channelization code length.

36. A transmitter according to claim 23, wherein the residual signal is formed by determining a residual value for each chip of a block as follows: if

the chip value is greater than the threshold value, the threshold value is subtracted from the chip and the result of this subtraction is the residual value; if the absolute value of the chip at most equals to the threshold value, the residual value is zero; if the chip value is lower than the negation of the threshold value, the threshold value is added to the chip value and the result of this addition is the residual value.

37. A transmitter according to claim 23, wherein the estimate of the residual signal is formed by multiplying each unused channelization code and the corresponding weighting factor and by adding up the products obtained.

38. A transmitter according to claim 23, wherein the estimate of the residual signal is formed by first determining a partial estimate by multiplying each unused channelization code and the corresponding weighting coefficient to obtain an input vector and by adding the selected sum vector to the input vector obtained, after which the partial estimates that were determined are added up.

39. A method according to claim 23, wherein the residual signal is formed by determining a residual value for each chip of the block as follows: if the chip value is at least zero, the standard deviation of the combined signal is subtracted from the chip value and the result of this subtraction is the residual value; if the chip value is lower than zero, the standard deviation of the combined signal is added to the chip value and the result of this addition is the residual value.

40. A transmitter according to claim 23, wherein all elements of the selected sum vector are zeroes.

41. A transmitter according to claim 23, wherein each selected sum vector includes at least one element that is different from zero.

42. A transmitter according to claim 23, wherein the signal to be added to the combined signal is a non-orthogonal signal.